CHAPTER VI
RECOVERY OF PRECIOUS METALS

A. GENERAL

The DoD Precious Metals Recovery Program (PMRP) promotes economic recovery of silver, gold and platinum family metals from excess and surplus precious metal-bearing materials, and also the utilization of recovered precious metals for authorized internal purposes or as Government Furnished Material (GFM) to DoD production and repair contractors. The platinum family includes platinum, palladium, iridium, rhodium, osmium, and ruthenium. Precious metals and their alloys are highly resistant to acids and corrosion. Among these alloys are **Platino,** which is an alloy of 89 percent gold and 11 percent platinum, **Palau,** which is an alloy of gold and palladium; and **Photanium,** which is a rhodium-gold alloy. **Platinum-rhodium** alloys are used in high temperature thermocouples. Platinum-iridium alloys are used for surgical instruments (25-30 percent iridium), jewelry (5-10 percent iridium), magneto contacts (20 percent iridium), and electrical contacts in control devices (10 percent iridium). Palladium and its alloys are used principally as substitutes for platinum, since they are much cheaper than platinum and similar to but not quite as wear resistant as platinum. Most palladium is alloyed with silver," molybdenum or other members of the platinum group. It is used for jewelry and for electrical purposes, such as potentiometer rubbing contacts and light duty impact contractors. Alloyed with gold, palladium is used in furnaces, in fuses designed to melt at a predetermined temperature inside furnaces, and in thermocouples (in conjunction with other platinum group metals and alloys). Alloys of palladium with copper, silver and gold are used in the manufacture of false teeth, where good corrosion resistance and good casting characteristics are important. Palladium alloys are also used for brazing **nickel alloys** and other high temperature resistant alloys which cannot be welded. The largest use for palladium is as a catalyst, either in a finely divided state or in the form of wire gauze.

B. PROCESSING PRECIOUS METAL-BEARING MATERIALS

When precious metal-bearing material becomes surplus to DoD requirements, it should then be segregated into lots of similar type and form. Ultimate recovery of precious metals from these lots is dependent on the form and composition of each lot; and recovery processes may vary according to the complexity of the property contained therein. In most cases precious metal-bearing materials which have been segregated will require additional processing to detach extraneous metal. (e.g., iron, aluminum, steel) and other attached materials. To the extent practicable with precious metal-bearing materials, ferrous materials should not be commingled with nonferrous materials, metallic materials with nonmetallic materials, or liquids with solids. In addition, for safety reasons, it is mandatory that precious metal-bearing materials containing hazardous or toxic substances (e.g., cyanide) be kept separate from nonhazardous materials. (See chapter IV for detailed guidance regarding the identification and segregation of precious metal-bearing materials.) More detailed guidance on precious metal-bearing property requiring special processing is contained in DoD 4160.21-M, Defense Utilization and Disposal Manual, chapter XVII.

C. SALE VERSUS RECOVERY

After proper segregation and sorting of precious metal-bearing materials have been accomplished, a cost-to-recover versus sale determination must be made. If this determination indicates that the property may have a commercial value in excess of the precious metals recovery value, it should be offered for sale. Furthermore, it is mandatory that the amount of precious metals contained therein be clearly indicated in subsequent sales descriptions of identical property.

D. EXAMPLES OF PRECIOUS METAL-BEARING PROPERTY

Listed below are DoD items that may contain economically recoverable precious metals.

1. *Silver-bearing Items:*

   Aircraft engine bearings, bushings, ring assemblies, link pins, slip rings, counterweights, gears and numerous other small parts
   Amalgam (silver and mercury)
   Anodes

Assemblies, electrical
Batteries (silver/copper, silver/cadmium, silver/zinc, and silver/magnesium)
Blanking scrap punchings
Brazing alloys
Bullion
Chemical salts
Clad bimetal parts
Contacts
Cyanide plating solutions and anode butts
Dental wire, tubes, strips, pellets and silver alloy powder
Desalting kits
Drugs (silver protein, silver iodate, silver nitrate and silver sulfate)
Electrical/electronic relays
Electric motor brushes
Flake (from hypo solution recovery systems)
Granulated powders
Jewelry sweeps
Mirroring solutions
Photographic film (photo negatives, industrial/medical X-ray and lithographic)
Photographic hypo solution
Photographic paper
Plated hooks or nodules
Plated electrical/electronic parts
Plated serving pieces
Plated utensils
Plated wire
Plating filters
Plating sludges/precipitates
Plating solutions
Radar antennas
Receiver assemblies
Resins
Silver-lined bearings (from diesels, locomotives or aircraft)
Sterling silver
Wave guides
Wiping rags

2. *Gold-bearing Items:*

Brazing alloy
Circuit boards and connectors
Copper amalgam plates
Dental sweeps (may also contain silver)
Dental scrap (up to 70 percent pure gold)
Dental wire (gold alloy)
Electron tubes
Eyeglass frames
Gold-bearing ion-exchange resins
Gold chemical ware and anodes
Gold-clad parts/connector pins
Gold salts/chemicals, solders
Gold solutions, sludges and precipitates
Gold wire
Jewelry and optical scrap
Relay/contact points
Semiconductor plates
Transistors and diodes
Uniform buttons
Military decorations/insignia

3. *Platinum/Platinum Family-bearing Items:*

Aircraft magneto and relay contact points
Aircraft spark plugs
Bracket, breaker and spring assemblies for aircraft magnetos
Dental alloy and dentures
Dental wire (platinum alloy)
Detonator fuses
Electronic tube grids
Evaporators and evaporator dishes
Laboratory ware, anodes, cathodes and crucibles
Platinum and platinum group catalysts
Platinum foil
Relays
Safety burst discs
Salts and derivatives
Semiconductors and resistant alloys
Solenoid switches (platinum)
Spark plug, resistor type, platinum electrode
Spinnerets and feeder dies
Switch contacts
Telephone switchboards (palladium)
Thermocouple wires
Triodes for various transmitting amplifiers
Voltage regulators

E. RECYCLING OF SCRAP REMAINING AFTER PRECIOUS METAL RECOVERY

This residue should be segregated and identified as outlined in chapter IV.